



Impact of dry years on some compounds of the hydrological balance in Chvojnica River catchment

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The question of climate changes and hydrological extremes is very topical. There are many reasons why hydrological extremes appear so often in the present. Extremes are mostly catastrophic for the mankind, but on the other hand their occurrence can be useful for studying processes of their formation.

The research was oriented on finding, which hydro-meteorological and catchment characteristics and indices can be used to describe local patterns of extremes in the Chvojnica River catchment located in the western part of Slovakia. A Czech hydrological model Bilan (Kasperek and Novicky in Tallaksen and van Lanen Eds., 2004) was used as a research tool. The dependency among soil moisture storage (SS) value, groundwater storage (GS) and single components of the total runoff was investigated. Monthly time series of discharges, precipitation, air temperatures and humidity with the length of 35 years were used in the model.

The course of the groundwater storage plot fitted quite well the distribution of years according to their humidity degree (based on yearly amount of precipitation). Within the observed time series, 13 normal years, 11 wet years, four dry years, two very wet years and five very dry years were identified. Until 1989, certain regularity could be distinguished in alteration of normal and extreme years. Normal years were altered with wet or dry years in a period of three to four years. Only one very dry year occurred during this period. The maximum groundwater storage (GS) value and the maximum soil moisture storage (SS) values are typical for winter months (December, January and February), and minimum values for the summer months (June, July and August). The mean GS values for winter months are 17 mm in December and 31 mm in January and February respectively. The mean GS value for summer months is only

0.13 mm. The mean values of the base flow, which are dependant on groundwater storage amounts, reached the average value of 17.44 mm in winter and values from 0 to 1 mm in the summer. In some years, the groundwater storage values were close to zero value. These years were classified as very dry years according to precipitation totals. Since 1989 to 2003, four very dry years occurred. This fact was reflected also in the time course of the potential evapotranspiration, evapotranspiration and air temperature showing an increasing character.

The unbalanced streamflow regime type is typical for the catchment. Among the reasons, the impermeability of the rock environment which is not able to store so much water is of big importance. Such conditions result in the amount of water flowing in the surface stream – almost dry river bed in dry seasons and occurrence of floods in wet years.

It is necessary to remark that utilization of a finer - daily time step would give much representative results for the study of surface and groundwater drought. Then it would be possible to estimate mechanisms producing local extremes in the catchment streamflows in more details.

References:

Tallaksen, L.M, van Lanen, A.J, Eds. 2004: Hydrological drought. Processes and estimation methods for streamflow and groundwater. - Development in water science 48, Elsevier, 2004: 579 pp.